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|  | **Unit 1: Biochemistry** | | | | | | | |
| Name: | | Start Date: | | | 08/28/17 |  |  |  |
|  | | Test 1 Date: | | | 09/25/17 |  |  |  |
| Period: (Honors) | | Teacher: Ms. Jost | | | |  |  |  |
|  | |  |  |  |  |  |  |  |
| **BIOCHEMISTRY** | | Submitted | Resubmit | Correct | Evidence of Learning | Page # | Date | Sign-Off |
| **Objective 1:** Compare the structures & functions of the major biological molecules, organic and **inorganic**, as related to the survival of organisms | |  |  |  | **Catalyst: Density**  **Lab: Properties of Water Investigation**  **HW: “Why do we need water” Article** | 3 |  |  |
|  |  |  | 4 |
|  |  |  | 7 |
|  |  |  | **Catalyst: Why do we need water?**  **Notes: Properties of Water**  **Properties of Water Illustrations**  **Documentary: The Future of Water** | 3 |  |
|  |  |  | 11 |
|  |  |  | 14 |
|  |  |  | -- |
|  |  |  | **HW: Properties of Water Review** | 16 |
|  |  |  | **Quiz: Objective 1 (Macromolecules and Water)** |  | 9/11 |

**Unit 1: BioChemistry**

Start Date: 08/28/17

Test 1 Date: 09/25/17

**Objective 1:** Compare the structures and functions of the major biological molecules, organic and inorganic, as related to the survival of organisms.

*Essential Question:* What are the subunits and functions of the four major groups of organic molecules?

*Essential Question:* What are the properties of water?

*“I Can” Statements:*

* Compare and contrast the four major organic macromolecule groups in terms of:
  + The formative elements
  + The formative subunits (monomers)
  + Functions within the cell/organism
  + Where found in the diet (food sources)
* Describe the major properties of water and explain the importance of these properties in the context of sustaining life:
  + Universal solvent
  + High specific heat
  + Adhesion and cohesion
  + Capillary action
  + Density

**Objective 2:**  Explain how enzymes act as catalysts for biological reactions.

*Essential Question:* How and why do enzymes catalyze biological reactions?

*“I Can” Statements:*

* Demonstrate the link between shape and function as it relates to an enzyme-substrate complex, as well as the effects of environmental factors (temperature, pH) on enzyme efficiency
* Develop a cause-and-effect model for specificity of enzymes

**Vocabulary**

* Activation Energy
* Adhesion
* Amino Acid
* Capillary Action
* Carbohydrate
* Catalyst
* Cohesion
* Denature
* DNA
* Density
* Enzyme
* Fatty Acid
* Hormone
* Inorganic
* Lipid
* Macromolecule
* Monomer
* Monosaccharide
* Nucleic Acid
* Nucleotide
* Organic
* Peptide Bond
* Polarity
* Polymer
* Polysaccharide
* Product
* Protein
* Reactant
* RNA
* Solvent
* Solute
* Substrate

**CATALYST 1**

**1. What does it mean for something to be dense?**

**2. Use an example to explain what you mean by dense.**

**3. Is density the same thing as mass?**

**Catalyst 2: TBD**

**Major Properties of Water Investigation**

**Directions**: There are 7 stations around the room, each with an experiment or activity to illustrate one of the 7 different properties of water. Follow the directions provided at each station and answer the questions for each station as you go.

|  |  |
| --- | --- |
| ***7 properties of water!*** | ***Data and Analysis*** |
| **Station #1: Density- (Liquid vs Liquid)**  Density is a measurement of the degree of compactness of molecules in a substance. The formula for density is mass ÷ volume, and is typically measured in g/mL. At this station you will test the densities of different liquid and compare them to each other. | **Part I**  **1. What is the density of water? Show your work.**  **2. What is the density of oil? Show your work.**  **3. What is the density of isopropyl alcohol? Show your work.**  **Part II**  **4. What happened when you add all three liquids into the same container?**  **5.Write the order of liquid from top to bottom.**  **6. Which liquid did you expect to be on the bottom? Why?**  **7. Which liquid was actually on the bottom? Why?** |
| **Station #2: Density continued (solid vs liquid).**  One unique property of water is that, unlike most substance, water is less dense in solid form. This is a result of the way water molecules arrange themselves when frozen. | **1. What happened when you initially put the ice in the oil?**  **2. What happened when the ice began to melt? Why?** |
| **Station #3: Adhesion**  Adhesion The term adhesion is derived from the Latin verb “adhaereō” meaning “I cling or stick to”. When describing water molecules, the term describes the property of water molecules to be attracted to molecules of other substance. | **1. Which tool did you chose to use and why?**  **2. How did you successfully transfer the water from one beaker to the next?**  **3. Thinking about the term “adhesion”, what do you think the water molecule are adhering or sticking to?** |
| **Station # 4: Cohesion**  The prefix “co-“ means “together; joint or jointly”. In the case of water, the slight charge or polarity of water molecules makes them attracted to each other and thus able to form droplets and strong surfaces. | **1. How many drops of alcohol were you able to get to stay on the penny?**  **2. How many drops of water were you able to get on the penny?**  **3. Thinking about the property of cohesion, what do your results suggest about cohesive forces within water compared to alcohol?** |
| **Station #5: Solvent Ability**  Water is often referred to as the “universal solvent” because of its ability to dissolve most things. While any polar substance can be dissolved by water, the same is not true for nonpolar substances like those composed of lipids.  Polar= slight charge, dissolvable by water  Nonpolar= no charge, not dissolvable by water  \*like dissolves like\* | **1. What happened when you added salt to Cup A?**  **2. What happened when you added sugar to Cup B?**  **3. What happened when you added oil to Cup C?**  **4. For each of the following substances you tested, propose whether they are polar or nonpolar and explain why.**   |  |  |  | | --- | --- | --- | | **Substance** | **Polarity** | **Explanation** | | Salt |  |  | | Sugar |  |  | | Oil |  |  | |
| **Station #6: Capillary Action**  The same property that allows us to drink from straws and for plants to get water up their roots, capillary action allows water to defy gravity. Using a mix of adhesive and cohesive forces, water is able to climb upwards against gravity. | **1. What happened when the water reached the ink?**  **2. Using what you know about cohesion and adhesion, what two things were the water molecules adhering to in this experiment?** |
| **Station #7: pH**  pH stands for “potential of hydrogen”. This value is use to measure how acidic or basic a solution is in term of the concentration of hydrogen ions. Pure water is said to have a pH of 7 which is neutral. Based on the pH scale, solutions with a high concentration of H+ ions are considered acidic and have a pH value below 7, where solution with a higher concentration of OH- ions are considered basic and have a pH value above 7. pH strips are indicators that change color according to the concentration of different ions in a solution. | **1. What is an indicator? How are pH strips an example of an indicator?**  **2. Which solutions were acidic?**  **3. Which solutions were basic?** |
| **Station #8: High Specific Heat**  Because of the unique attraction of water molecules to each other, it requires a lot of energy to break the bonds between water molecules and increase the temperature of water. This is a big part of the reason why our blood doesn’t boil when we stay out in the sun or in warmer climates. | **1. Referring to the picture of the beach, what do you think is hotter, the sand or the water? Explain why.**  **2. Why might this be an especially important property when it comes to aquatic organisms?**  **3. What do you think the definition of Heat Capacity is?** |

# **Why Is Drinking Water Important?**

Last updated Tue 4 October 2016

By [James McIntosh](http://www.medicalnewstoday.com/authors/james-mcintosh)

Reviewed by Natalie Butler, RD, LD

[4011](http://www.medicalnewstoday.com/articles/290814.php)

**Most people take drinking water for granted, but keeping hydrated has a huge impact on overall health. Despite how crucial water is, a significant number of people fail to consume recommended levels of fluids each day.**

Around 70 percent of the body is comprised of water, and around [71 percent](http://water.usgs.gov/edu/earthhowmuch.html) of the planet's surface is covered by water. Perhaps it is the ubiquitous nature of water that means drinking enough each day is not at the top of many people's lists of priorities.

Fast facts on drinking water

Here are some key points about drinking water. More detail and supporting information is in the main article.

* Humans are 70 percent water, and our blood is 90 percent water
* There is no universally agreed quantity of water that must be consumed daily
* Water is essential for the kidneys to function
* When dehydrated, the skin can become more vulnerable to skin disorders and wrinkling
* In a CDC questionnaire, 7 percent of respondents reported drinking no water at all daily

## Why do we need to drink water?

To function properly, all the cells and organs of the body need water. It is also used to lubricate the joints, protect the spinal cord and other sensitive tissues, regulate body temperature, and assist the passage of food through the intestines.

Although some of the water required by the body is obtained through foods with a high water content - soups, tomatoes, oranges - the majority is gained through drinking water and other beverages.

During every day functioning, water is lost by the body, and this needs to be replaced. It is noticeable that we lose water through activities such as sweating and urination, but water is even lost when breathing.

Drinking water, be it from the tap or a bottle, is the best source of fluid for the body. Beverages such as milk and juices are also decent sources of fluid, but beverages containing alcohol and caffeine, such as soft drinks, coffee, and beer, are not ideal because they often contain empty [calories](http://www.medicalnewstoday.com/articles/245588.php).

It was previously thought that caffeinated beverages had diuretic properties, meaning that they cause the body to release water. However, [studies show](https://www.ncbi.nlm.nih.gov/pubmed/19774754) that fluid loss because of caffeinated drinks is minimal.

## How much water should you drink?

The recommended amount of water to be drunk per day [varies from person to person](http://www.mayoclinic.org/healthy-lifestyle/nutrition-and-healthy-eating/in-depth/water/art-20044256), depending on factors such as how active they are and how much they sweat. There is no universally agreed upon amount of water that must be consumed daily, but there is a general level of consensus as to what a healthy amount is. According to the [Institute of Medicine](http://www.nationalacademies.org/hmd/~/media/Files/Activity%20Files/Nutrition/DRIs/New%20Material/9_Electrolytes_Water%20Summary.pdf) (IOM), an adequate intake for men is approximately 13 cups (3 liters) a day. For women, an adequate intake is around 9 cups (2.2 liters).

Many people will have heard the phrase, "drink eight 8-ounce glasses of water a day," which works out at around 1.9 liters and is close to the IOM's recommendation for women. Drinking "8 by 8" is an easy-to-remember amount that can put people on the right track regarding water consumption. Remember, all non-alcoholic fluid counts towards this recommendation.

Water also helps dissolve minerals and nutrients so that they are more accessible to the body, as well as helping transport waste products out of the body. It is these two functions that make water so vital to the kidneys.

## How does not drinking enough affect the kidneys?

The role of the kidneys in keeping the body healthy may be underrated in relation to the heart and lungs.

Every day, the kidneys filter around [120-150 quarts](https://www.niddk.nih.gov/health-information/health-topics/Anatomy/kidneys-how-they-work/Pages/anatomy.aspx) of fluid. Of these, approximately 1-2 quarts are removed from the body in the form of urine, and 198 are recovered by the bloodstream. Water is essential for the kidneys to function.

If the kidneys do not function properly, waste products and [excess fluid](https://www.kidney.org/kidneydisease/howkidneyswrk) can build up inside the body.

Untreated, chronic kidney disease can lead to kidney failure, whereby the organs stop working, and either dialysis or kidney transplantation is required.

Urinary tract infections (UTIs) are the [second most common](https://www.niddk.nih.gov/health-information/health-topics/urologic-disease/urinary-tract-infections-in-adults/Pages/facts.aspx) type of infection in the body and account for around 8.1 million visits to health care providers in the U.S. every year.

If infections spread to the upper urinary tract, including the kidneys, permanent damage can be caused. Sudden kidney infections (acute) can be life-threatening, particularly if septicemia occurs.

Drinking plenty of water is one of the simplest ways to reduce the risk of developing a UTI and is also recommended to those who have already developed a UTI.

[Kidney stones](http://www.medicalnewstoday.com/articles/154193.php) interfere with how the kidneys work and, when present, can complicate UTIs. These complicated UTIs tend to require longer periods of antibiotics to treat them, typically lasting 7-14 days.

The leading cause of kidney stones is a lack of water; they are commonly reported in people who do not drink the recommended daily amount of water. As well as complicating UTIs, research has suggested that kidney stones also increase the risk of [chronic kidney disease](https://www.niddk.nih.gov/health-information/health-communication-programs/nkdep/a-z/questions-answers-kidney-disease/Pages/default.aspx).

In November 2014, the American College of Physicians issued new guidelines for people who have previously developed kidney stones, stating that increasing fluid intake to enable 2 liters of urination a day could decrease the risk of stone recurrence by at least half with no side effects.

[Dehydration](http://www.mayoclinic.org/diseases-conditions/dehydration/basics/complications/con-20030056) - using and losing more water than the body takes in - can also lead to an imbalance in the body's electrolytes. Electrolytes, such as [potassium](http://www.medicalnewstoday.com/articles/287212.php), phosphate, and sodium, help carry electrical signals between cells. The levels of electrolytes in the body are kept stable by properly functioning kidneys.

When the kidneys are unable to maintain a balance in the levels of electrolytes, these electrical signals become mixed up, which can lead to seizures, involving involuntary muscle movements and loss of consciousness.

In severe cases, [dehydration](http://www.medicalnewstoday.com/articles/153363.php) can also result in kidney failure, a potentially life-threatening outcome. Possible complications of chronic kidney failure include anemia, damage to the central nervous system, heart failure, and a compromised immune system.

## Effects on other organs

Of course, it is [not just the kidneys](http://www.mayoclinic.org/healthy-lifestyle/nutrition-and-healthy-eating/multimedia/functions-of-water-in-the-body/img-20005799) that are affected by a lack of water; below is a small sample of the other negative consequences dehydration can bring:

* Blood is more than 90 percent water, therefore, if water is in short supply, blood can become thicker and increase [blood pressure](http://www.medicalnewstoday.com/articles/270644.php).
* When dehydrated, airways are restricted by the body in an effort to minimize water loss, potentially making [asthma](http://www.medicalnewstoday.com/info/asthma/) and allergies worse.
* The skin can become more vulnerable to skin disorders and premature wrinkling.
* The bowel needs water to function correctly. If dehydrated, digestive problems and [constipation](http://www.medicalnewstoday.com/articles/150322.php) can become an issue. Dehydration can lead to an overly acidic stomach which makes [heartburn](http://www.medicalnewstoday.com/articles/9151.php) more common and can encourage the development of stomach ulcers.
* Cartilage, found in joints and the disks of the spine, contain around 80 percent water. If dehydration is ongoing, joints can become less good at shock absorption, which leads to joint pain.
* Dehydration can affect brain structure and function. If dehydration is prolonged, cognitive ability is impaired.

## Does the U.S. drink enough water?

A study carried out by the Centers for Disease Control and Prevention (CDC) in 2013 analyzed data from the National Cancer Institute's 2007 [Food Attitudes and Behaviors Survey](http://www.cdc.gov/pcd/issues/2013/12_0248.htm).

Out of a sample of 3,397 adults, the researchers found the following:

* 7 percent of adults reported no daily consumption of drinking water
* 36 percent of adults reported drinking 1-3 cups of drinking water a day
* 35 percent of adults reported drinking 4-7 cups of drinking water a day
* 22 percent of adults reported drinking 8 cups or more a day

People were more likely to drink less than 4 cups of drinking water daily if they consumed 1 cup or less of fruits or vegetables a day.

The study only measured the intake of drinking water and, of course, fluid can be gained from other beverages. However, water is the ideal source of fluid because it is calorie-free, caffeine-free, and alcohol-free.

Because 7 percent of respondents reported drinking no water at all daily, and those who drank a low volume of water also consumed less fruit and vegetables, it suggests that there is a certain number of people who are risking their health by not getting enough fluid.

Even if the respondents reporting low levels of water intake were obtaining enough fluid, it is likely that they would be obtaining it from sources that could potentially compromise their health in other ways.

"The biologic requirement for water may be met with plain water or via foods and other beverages," write the study authors. "Results from previous epidemiologic studies indicate that water intake may be inversely related to volume of calorically sweetened beverages and other fluid intake."

**Notes: Properties of Water**

**Summary and Questions:**

**I. Structure of Water**

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**II. Water is POLAR**

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**III. Hydrogen bonding**

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**IV. 7 Properties of Water**

**1. Density**

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**2. Cohesion**

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**3. Adhesion**

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**4. Capillary Action**

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**5. Universal Solvent**

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**6. Specific Heat**

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**7. pH**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**HW: Properties of Water Illustrations**

In the chart below fill in the definition for each characteristic of water, accompanied by an illustration of each property.

|  |  |  |
| --- | --- | --- |
| ***Characteristic of water*** | ***Definition*** | ***Illustration*** |
| **Polarity** |  |  |
| **Hydrogen bonding** |  |  |
| **Cohesion** |  |  |
| **Adhesion** |  |  |
| **Surface Tension** |  |  |
| **Capillary Action** |  |  |
| **Solid is less dense than liquid** |  |  |
| **High Specific Heat** |  |  |
| **Universal Solvent** |  |  |

**Properties of Water Review**

1. Write the chemical equation for water. \_\_\_\_\_\_\_\_\_\_\_\_

2. Sketch a model of a water molecule, show polarity by labeling positive and negatively charged regions of the molecule.

3. How is a water molecule like a magnet? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. List the seven properties of water:

1.

2.

3.

4.

5.

6.

7.

5. What causes surface tension in water?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6. Give an example that you observed of surface tension.

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7. Define cohesion in your own words. Give an example.

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8. Define adhesion in your own words. Give an example.

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9. How does water get to the leaves in the tops of the tallest trees against the force of gravity? Name property responsible for this and explain how it works.

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10. Why is solid water less dense than liquid water?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

11. In the space below, write a short paragraph explain **two** different properties of water and why they are important for sustaining life.

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